

[0001] The present invention relates to compositions for oxidation dyeing keratinous fibers, for example, human keratinous fibers such as hair, comprising, in a medium suitable for dyeing, at least one oxidation dye precursor chosen from 1-(4-aminophenyl)-pyrrolidines and acid addition salts thereof, and at least one cationic polymer.

[0002] It is known to dye keratinous fibers, for example, human hair, with dyeing compositions comprising oxidation dye precursors, generally called "oxidation bases." Representative oxidation bases include ortho- and para-phenylenediamines, ortho- and para-aminophenols, and heterocyclic bases.

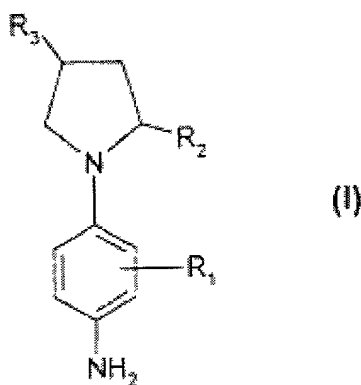
[0003] Oxidation dye precursors are compounds initially only slightly colored or not colored that develop their dyeing power in the hair in the presence of oxidizing agents, leading to the formation of colored compounds. The formation of these colored compounds results either from oxidative condensation of the "oxidation bases" with themselves, or oxidative condensation of the "oxidation bases" with color-modifying compounds, or "couplers," which are generally present in the dyeing compositions used in oxidation dyeing. Representative couplers include meta-phenylenediamines, meta-aminophenols, meta-diphenols, and certain heterocyclic compounds.

[0004] The variety of compositions that can be employed in oxidation coloration, chosen from oxidation bases, oxidation couplers and mixtures of oxidation bases and couplers, can contribute to a palette very rich in color.

[0005] It is desirable for such oxidation dyes, otherwise called "permanent" dyes, to satisfy at least one of the following—make it possible to obtain shades of the desired intensity and tend to exhibit good resistance toward at least one external agent, such as,

WHAT IS CLAIMED IS:

1. A composition for oxidation dyeing keratinous fibers comprising, in a medium suitable for dyeing:
 - (iii) at least one oxidation dye precursor chosen from 1-(4-aminophenyl)-pyrrolidines of formula (I) and acid addition salts thereof:



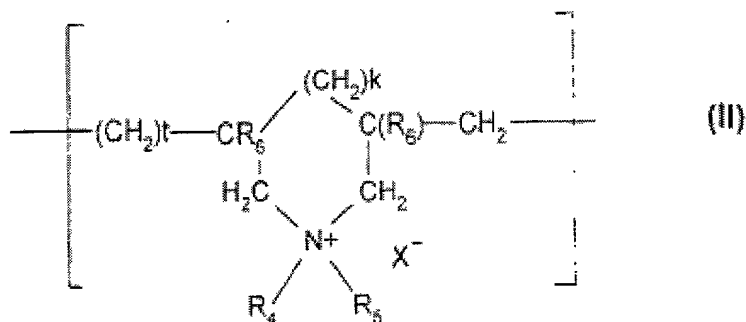
wherein:

- R_1 is chosen from a hydrogen atom, C_1 - C_6 alkyl groups, C_1 - C_5 monohydroxyalkyl groups, and C_2 - C_5 polyhydroxyalkyl groups,
- R_2 is chosen from a hydrogen atom, a $-CONH_2$ group, C_1 - C_5 monohydroxyalkyl groups, and C_2 - C_5 polyhydroxyalkyl groups, and
- R_3 is chosen from a hydrogen atom, and a hydroxyl group, and

- (ii) at least one cationic polymer chosen from:

- (1) homopolymers and copolymers comprising, as a constituent of the chain, at

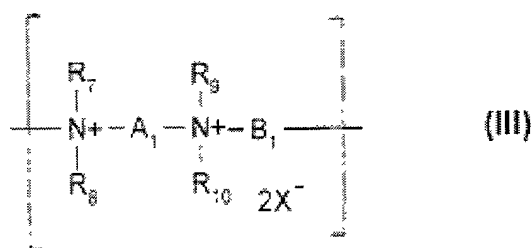
least one unit chosen from units formula (II):



wherein:

- k and t, which are identical or different, are each chosen from 0 and 1,
provided that the sum of k + t is equal to 1,
- R₄ and R₅, which are identical or different, are each chosen from
(C₁-C₂₂) alkyl groups, (C₁-C₅)-hydroxyalkyl groups, and
(C₁-C₄)amidoalkyl groups,
- R₄ and R₅, together with the nitrogen cation to which they are commonly
bonded, optionally form a cationic heterocyclic group chosen from a
piperidinyl group and a morpholinyl group,
- R₆, which are identical or different, are each chosen from a hydrogen atom
and a methyl group, and
- X⁻ is an anion;

(2) quaternary diammonium polymers comprising repeating units of formula (III):



wherein:

- R_7 , R_8 , R_9 , and R_{10} , which are identical or different, are each chosen from C_1 - C_{20} aliphatic groups, C_3 - C_{20} alicyclic groups, C_7 - C_{20} arylaliphatic groups, and lower hydroxyalkyl groups,
- at least two of said R_7 , said R_8 , said R_9 , and said R_{10} , together with the nitrogen cations to which they are attached, optionally form at least one cationic heterocyclic ring optionally comprising an additional heteroatom other than nitrogen,
- R_7 , R_8 , R_9 , and R_{10} , which are identical or different, are each optionally chosen from linear and branched C_1 - C_6 alkyl groups substituted with at least one group chosen from nitrile groups, ester groups, acyl groups, amide groups, $-\text{CO}-\text{O}-R_{11}-\text{D}$ groups, and $-\text{CO}-\text{NH}-R_{11}-\text{D}$ groups, wherein R_{11} is chosen from alkylene groups and D is chosen from quaternary ammonium groups,
- A_1 and B_1 , which are identical or different, are each chosen from linear and branched, saturated and unsaturated, C_2 - C_{20} polymethylene groups, optionally comprising at least one entity chosen from aromatic rings,

an oxygen atom, a sulfur atom, a sulfoxide group, a sulfone group, a disulfide group, an amino group, alkylamino groups, a hydroxyl group, quaternary ammonium groups, a ureido group, an amide group, and ester groups, wherein said at least one entity is linked to or intercalated in the main chain,

- X^- is an anion,
 - said A_1 , said R_7 , and said R_9 optionally form a piperazine ring, together with the two nitrogen cations to which they are attached, and
 - provided that if A_1 is chosen from linear and branched, saturated and unsaturated, C_2 - C_{20} polymethylene groups and linear and branched, saturated and unsaturated, hydroxy(C_2 - C_{20})polymethylene groups, B_1 is chosen from
 - (CH_2) $_n$ -CO-D-OC-(CH_2) $_n$ - groups, wherein:
 - n is an integer ranging from 1 to 100,
 - D is chosen from:
 - a) glycol residues of formula: -O-Z-O-, wherein Z is chosen from linear and branched hydrocarbon groups and groups chosen from groups of formulae:
 - (CH_2 - CH_2 -O) $_x$ - CH_2 - CH_2 - and
 - [CH_2 -CH(CH_3)-O] $_y$ - CH_2 -CH(CH_3)-
- wherein x and y , which are identical or different, are each chosen from integers ranging from 1 to 4 (in which case x and y represent a defined and unique degree of polymerization) and

any number ranging from 1 to 4 (in which case x and y represent an average degree of polymerization),

b) bis-secondary diamine residues,

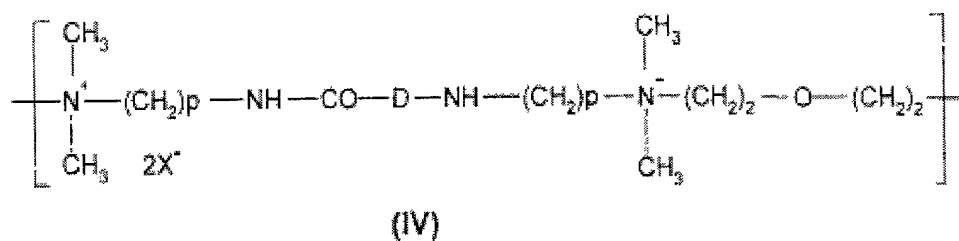
c) bis-primary diamine residues chosen from residues of formula:

-NH-Y-NH-, wherein Y is chosen from linear and branched hydrocarbon groups and residues of formula

-CH₂-CH₂-S-S-CH₂-CH₂-, and

d) a ureylene group of formula: -NH-CO-NH-;

(3) quaternary diammonium polymers comprising repeating units of formula (IV):



wherein:

- p is an integer ranging from 1 to 6,

- D is chosen from a direct bond and -(CH₂)_r-CO- groups, wherein r is a number equal to 4 or 7, and

- X⁻ is an anion;

(4) amine-containing silicones.

2. A composition according to claim 1, wherein said keratinous fibers are human keratinous fibers.

3. A composition according to claim 2, wherein said human keratinous fibers are human hair.

4. A composition according to claim 1, wherein said n of said $-(CH_2)_n-CO-D-OC-(CH_2)_n-$ groups is an integer ranging from 1 to 50.

5. A composition according to claim 1, wherein said R_1 , said R_2 , and said R_3 are each a hydrogen atom.

6. A composition according to claim 1, wherein said R_1 and said R_3 are each a hydrogen atom and said R_2 is a $-CH_2OH$ group.

7. A composition according to claim 1, wherein said R_1 is a hydrogen atom, said R_2 is a $-CH_2OH$ group, and said R_3 is a hydroxyl group.

8. A composition according to claim 1, wherein said R_1 and said R_3 are each a hydrogen atom and said R_2 is a $-CONH_2$ group.

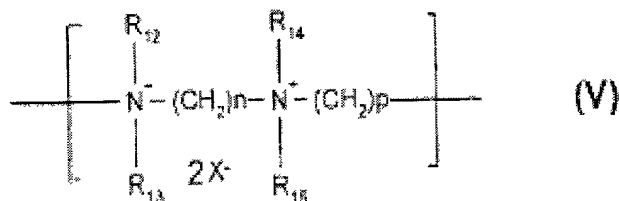
9. A composition according to claim 1, wherein said acid addition salts of said 1-(4-aminophenyl)pyrrolidines of formula (I) are chosen from hydrochlorides, hydrobromides, sulphates, tartrates, lactates, and acetates.

10. A composition according to claim 1, wherein said at least one oxidation dye precursor is present in said composition in an amount ranging from 0.001% to 10% by weight relative to the total weight of the composition.

11. A composition according to claim 10, wherein said at least one oxidation dye precursor is present in said composition in an amount ranging from 0.01% to 8% by weight relative to the total weight of the composition.

12. A composition according to claim 1, wherein said quaternary diammonium polymers comprising repeating units of formula (III) are chosen from cationic polymers

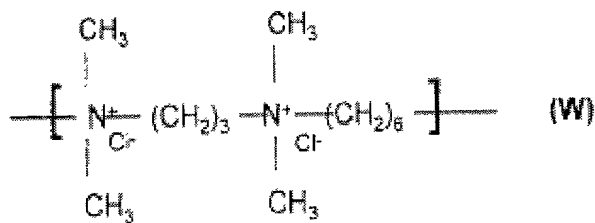
comprising repeating units of formula (V):



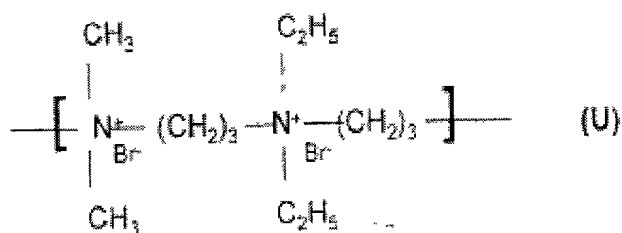
wherein

- R_{12} , R_{13} , R_{14} , and R_{15} , which are identical or different, are each chosen from C_1 - C_4 alkyl groups and C_1 - C_4 hydroxyalkyl groups, and
- n and p are each chosen from integers ranging from 2 to 20, and
- X^- is an anion.

13. A composition according to claim 12, wherein said cationic polymers comprising repeating units of formula (V) are chosen from cationic polymers comprising repeating units of formula (W):



14. A composition according to claim 12, wherein said cationic polymers comprising repeating units of formula (V) are chosen from cationic polymers comprising repeating units of formula (U):



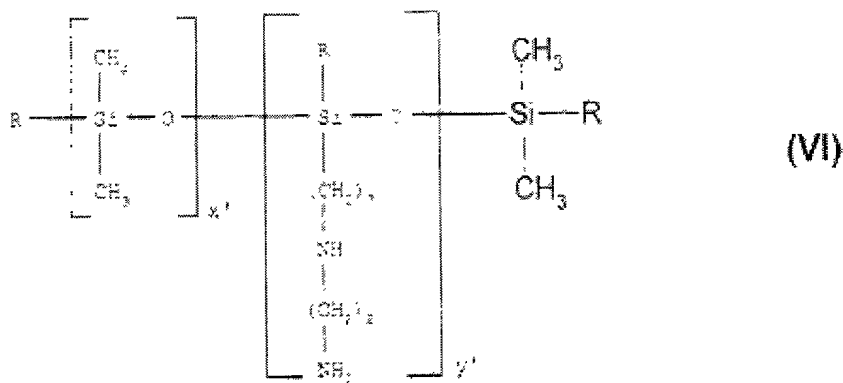
15. A composition according to claim 1, wherein said at least one cationic polymer is chosen from quaternary diammonium polymers comprising repeating units of formula (IV), wherein:

- p is chosen from integers ranging from 1 to 6,
- D is chosen from a direct bond and $-(\text{CH}_2)_r\text{-CO-}$ groups, wherein r is a number equal to 4 or 7, and
- X^- is an anion chosen from anions derived from inorganic acids and anions derived from organic acids.

16. A composition according to claim 15, wherein said p is equal to 3, said D is a direct bond, and said X^- is a chlorine anion.

17. A composition according to claim 1, wherein said at least one amine-containing silicone is chosen from:

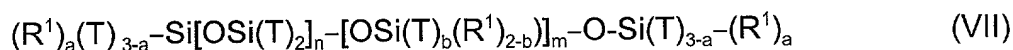
- (i) polysiloxanes of formula (VI):



wherein:

- R is a group chosen from a methyl group and a hydroxyl group, and
- x' and y' are integers chosen such that the weight-average molecular weight of said polysiloxane ranges from 5,000 to 500,000;

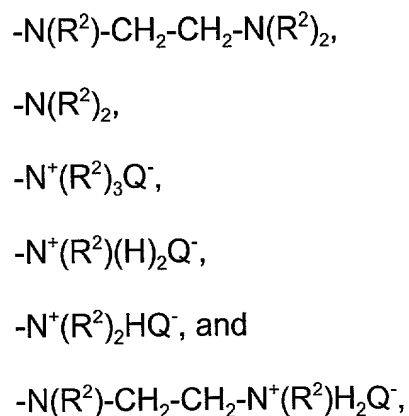
(ii) aminosilicones of formula (VII):



wherein:

- T is chosen from a hydrogen atom, a phenyl group, a hydroxyl group, and (C₁-C₈) alkyl groups,
- a is an integer ranging from 0 to 3,
- b is chosen from 0 and 1,
- m and n are numbers such that the sum (n + m) ranges from 1 to 2,000,

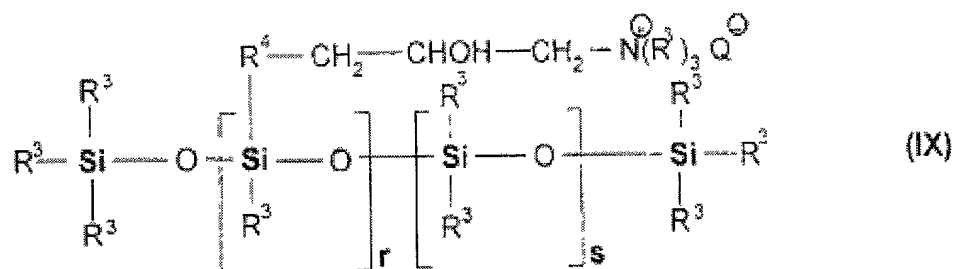
- n is chosen from a number ranging from 0 to 1,999,
- m is chosen from a number ranging from 1 to 2,000,
- R¹ is a monovalent group of formula -C_qH_{2q}L, wherein q is chosen from a number ranging from 2 to 8, and wherein L is an optionally quaternized amine group chosen from:



wherein

- R², which are identical or different, are each chosen from a hydrogen atom, a phenyl group, a benzyl group, and (C₁-C₂₀) alkyl groups, and
- Q⁻ is chosen from halide anions;

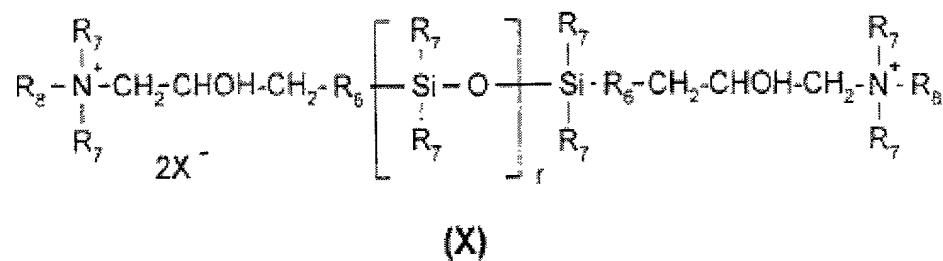
(iii) aminosilicones of formula (IX):



wherein:

- R^3 , which are identical or different, are each chosen from (C_1-C_{18}) alkyl groups and (C_2-C_{18}) alkenyl groups,
- R_4 is chosen from divalent (C_1-C_{18}) alkylene groups, and divalent (C_1-C_{18}) alkyleneoxy groups,
- Q^- is chosen from halide anions,
- r is a mean statistical value ranging from 2 to 20, and
- s is a mean statistical value ranging from 20 to 200;

(iv) silicones of formula (X):

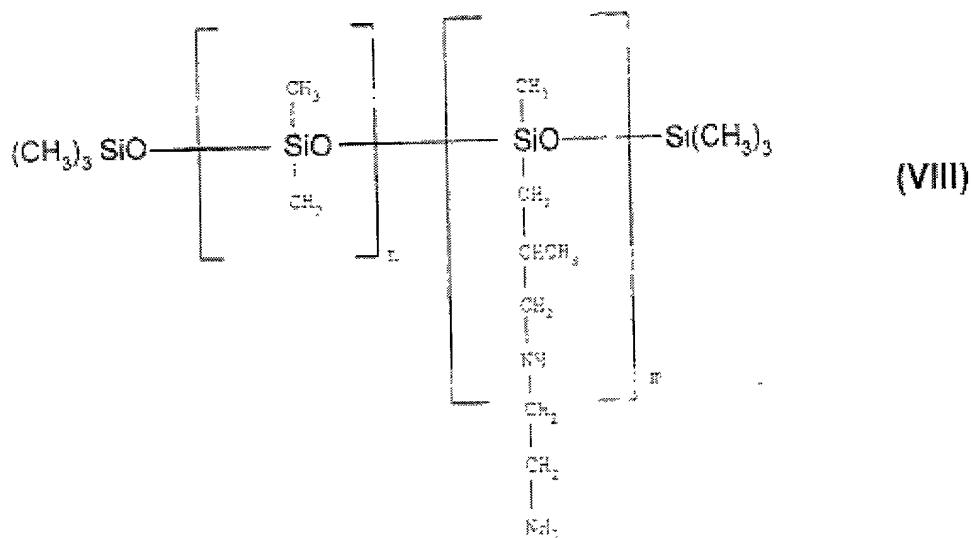


wherein:

- R_6 is chosen from divalent (C_1-C_{18}) alkylene groups, and divalent (C_1-C_{18}) alkyleneoxy groups, wherein said R_6 is bonded to the Si by way of an SiC bond,
- R_7 , which are identical or different, are each chosen from (C_1-C_{18}) monovalent hydrocarbon-based groups, (C_2-C_{18}) alkenyl groups, and (C_5-C_6) rings,
- R_8 , which are identical or different, are each chosen from a hydrogen atom, (C_1-C_{18}) monovalent hydrocarbon-based groups, (C_2-C_{18}) alkenyl groups, and $-R_6-NHCOR_7$ groups, wherein said R_6 and said R_7 are defined above,

- r is a mean statistical value ranging from 2 to 200, and
- X⁻ is an anion.

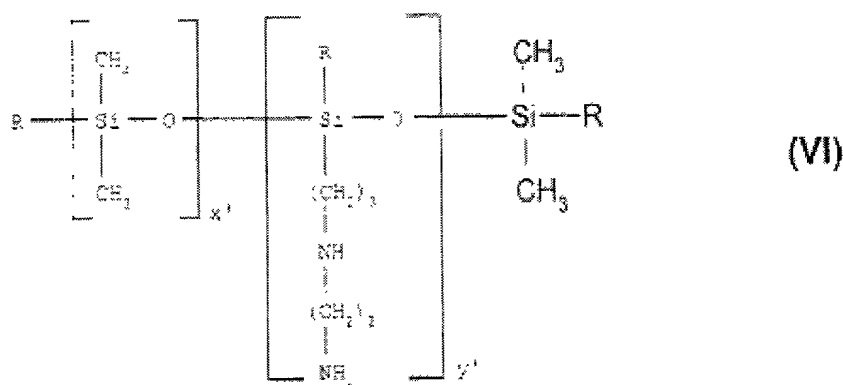
18. A composition according to claim 1, wherein said at least one cationic polymer is chosen from trimethylsilylamodimethicones of formula (VIII):



wherein:

- m and n are numbers such that the sum (n + m) ranges from 1 to 2,000,
- n is chosen from a number ranging from 0 to 1,999, and
- m is chosen from a number ranging from 1 to 2,000.

19. A composition according to claim 1, wherein said at least one cationic polymer is chosen from polysiloxanes of formula (VI):



wherein:

- R is a group chosen from a methyl group and a hydroxyl group, and
- x' and y' are integers chosen such that the weight-average molecular weight of said polysiloxane ranges from 5,000 to 500,000;

and wherein said composition further comprises:

- (i) trimethylcetylammmonium chloride, and
- (ii) at least one compound of formula: $\text{C}_{13}\text{H}_{27}-(\text{OC}_2\text{H}_4)_{12}-\text{OH}$.

20. A composition according to claim 18, wherein said composition further comprises:

- (i) at least one nonionic surfactant of formula: $\text{C}_8\text{H}_{17}-\text{C}_6\text{H}_4-(\text{OCH}_2\text{CH}_2)_{40}-\text{OH}$,
- (ii) at least one nonionic surfactant of formula: $\text{C}_{12}\text{H}_{25}-(\text{OCH}_2-\text{CH}_2)_6-\text{OH}$, and
- (iii) propylene glycol.

21. A composition according to claim 1, wherein said at least one cationic polymer is present in said composition in an amount ranging from 0.01% to 10% by weight relative to the total weight of the composition.

22. A composition according to claim 21, wherein said at least one cationic polymer is present in said composition in an amount ranging from 0.05% to 5% by weight relative to the total weight of the composition.

23. A composition according to claim 22, wherein said at least one cationic polymer is present in said composition in an amount ranging from 0.1% to 3% by weight relative to the total weight of the composition.

24. A composition according to claim 1 further comprising at least one coupler.

25. A composition according to claim 24, wherein said at least one coupler is chosen from meta-phenylenediamines, meta-aminophenols, meta-diphenols, naphthols, heterocyclic couplers, and acid addition salts of any of the foregoing compounds.

26. A composition according to claim 24, wherein said at least one coupler is chosen from 2,4-diamino-1-(β -hydroxyethyloxy)benzene, 2-methyl-5-aminophenol, 5-N-(β -hydroxyethyl) amino-2-methylphenol, 3-aminophenol, 1,3-dihydroxybenzene, 1,3-dihydroxy-2-methylbenzene, 4-chloro-1,3-dihydroxy-benzene, 2-amino-4-(β -hydroxyethylamino)-1-methoxy-benzene, 1,3-diaminobenzene, 1,3-bis(2,4-diaminophenoxy)propane, sesamol, 1-amino-2-methoxy-4,5-methylenedioxybenzene, α -naphthol, 6-hydroxyindole, 4-hydroxyindole, 4-hydroxy-N-methylindole, 6-hydroxy-indoline, 2,6-dihydroxy-4-methylpyridine, 1-H-3-methyl-pyrazol-5-one, 1-phenyl-3-methylpyrazol-5-one, 2-amino-3-hydroxypyridine, 3,6-dimethylpyrazolo[3,2-c]-1,2,4-triazole, 2,6-dimethylpyrazolo[1,5-b]-1,2,4-triazole and acid addition salts of any of the foregoing compounds.

27. A composition according to claim 24, wherein said at least one coupler is present in said composition in an amount ranging from 0.0001% to 15% by weight relative

to the total weight of the composition.

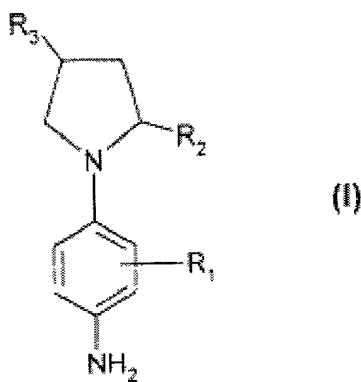
28. A composition according to claim 1 further comprising at least one oxidation base, other than said at least one oxidation dye precursor, in an amount ranging from 0.0001% to 15% by weight relative to the total weight of said composition.

29. A composition according to claim 1 further comprising at least one direct dye in an amount ranging from 0.001% to 20% by weight relative to the total weight of said composition.

30. A composition according to claim 1 further comprising at least one agent chosen from reducing agents and antioxidants, wherein said at least one agent is present in said composition in an amount ranging from 0.05% to 1.5% by weight relative to the total weight of said composition.

31. A composition for oxidation dyeing keratinous fibers comprising, in a medium suitable for dyeing:

- (i) at least one oxidation dye precursor chosen from 1-(4-aminophenyl)-pyrrolidines of formula (I) and acid addition salts thereof:

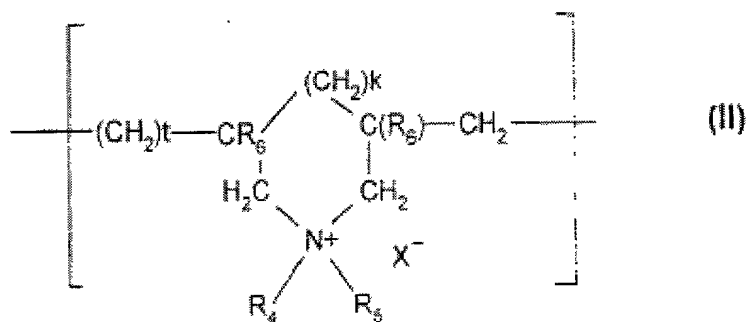


wherein:

- R_1 is chosen from a hydrogen atom, C_1 - C_6 alkyl groups, C_1 - C_5 monohydroxyalkyl groups, and C_2 - C_5 polyhydroxyalkyl groups,
- R_2 is chosen from a hydrogen atom, a $-\text{CONH}_2$ group, C_1 - C_5 monohydroxyalkyl groups, and C_2 - C_5 polyhydroxyalkyl groups, and
- R_3 is chosen from a hydrogen atom, and a hydroxyl group, and

(ii) at least one cationic polymer chosen from:

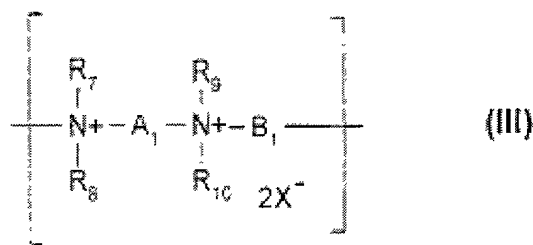
- (1) homopolymers and copolymers comprising, as a constituent of the chain, at least one unit chosen from units formula (II):



wherein:

- k and t , which are identical or different, are each chosen from 0 and 1, provided that the sum of $k + t$ is equal to 1,
- R_4 and R_5 , which are identical or different, are each chosen from $(C_1$ - $C_{22})$ alkyl groups, $(C_1$ - $C_5)$ -hydroxyalkyl groups, and $(C_1$ - $C_4)$ amidoalkyl groups,

- R_4 and R_5 , together with the nitrogen cation to which they are commonly bonded, optionally form a cationic heterocyclic group chosen from a piperidinyl group and a morpholinyl group,
 - R_6 , which are identical or different, are each chosen from a hydrogen atom and a methyl group, and
 - X^- is an anion;
- (2) quaternary diammonium polymers comprising repeating units of formula (III):



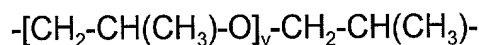
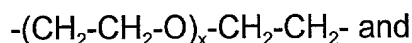
wherein:

- R_7 , R_8 , R_9 , and R_{10} , which are identical or different, are each chosen from C_1 - C_{20} aliphatic groups, C_3 - C_{20} alicyclic groups, C_7 - C_{20} arylaliphatic groups, and lower hydroxyalkyl groups,
- at least two of said R_7 , said R_8 , said R_9 , and said R_{10} , together with the nitrogen cations to which they are attached, optionally form at least one cationic heterocyclic ring optionally comprising an additional heteroatom other than nitrogen,
- R_7 , R_8 , R_9 , and R_{10} , which are identical or different, optionally are each

chosen from linear and branched C_1 - C_6 alkyl groups substituted with at least one group chosen from nitrile groups, ester groups, acyl groups, amide groups, $-CO-O-R_{11}-D$ groups, and $-CO-NH-R_{11}-D$ groups, wherein R_{11} is chosen from alkylene groups and D is chosen from quaternary ammonium groups,

- A_1 and B_1 , which are identical or different, are each chosen from linear and branched, saturated and unsaturated, C_2 - C_{20} polymethylene groups, optionally comprising at least one entity chosen from aromatic rings, an oxygen atom, a sulfur atom, a sulfoxide group, a sulfone group, a disulfide group, an amino group, alkylamino groups, a hydroxyl group, quaternary ammonium groups, a ureido group, an amide group, and ester groups, wherein said at least one entity is linked to or intercalated in the main chain,
- X^- is an anion,
- said A_1 , said R_7 , and said R_9 optionally form a piperazine ring, together with the two nitrogen cations to which they are attached, and
- provided that if A_1 is chosen from linear and branched, saturated and unsaturated, C_2 - C_{20} polymethylene groups and linear and branched, saturated and unsaturated, hydroxy(C_2 - C_{20})polymethylene groups, B_1 is additionally chosen from $-(CH_2)_n-CO-D-OC-(CH_2)_n-$ groups, wherein:
 - n is an integer ranging from 1 to 100, and
 - D is chosen from:
 - a) glycol residues of formula: $-O-Z-O-$, wherein Z is chosen from linear

and branched hydrocarbon groups and groups chosen from groups of formulae:

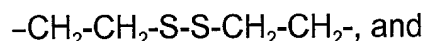


wherein x and y, which are identical or different, are each chosen from integers ranging from 1 to 4 (in which case x and y represent a defined and unique degree of polymerization) and any number ranging from 1 to 4 (in which case x and y represent an average degree of polymerization),

b) bis-secondary diamine residues,

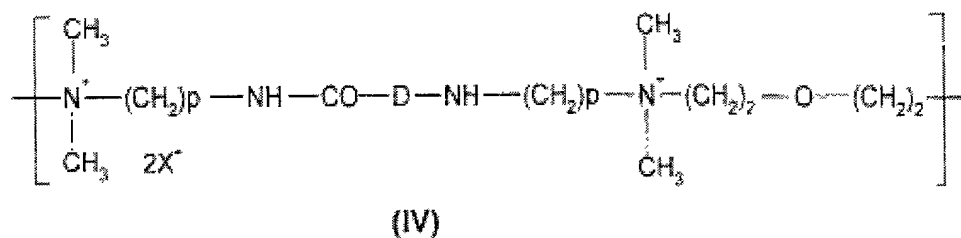
c) bis-primary diamine residues chosen from residues of formula:

$-\text{NH}-\text{Y}-\text{NH}-$, wherein Y is chosen from linear and branched hydrocarbon groups and residues of formula



d) a ureylene group of formula: $-\text{NH}-\text{CO}-\text{NH}-$;

(3) quaternary diammonium polymers comprising repeating units of formula (IV):



wherein:

- p is an integer ranging from 1 to 6,
- D is chosen from a direct bond and $-(CH_2)_r-CO-$ groups, wherein r is a number equal to 4 or 7, and
- X^- is an anion;

(4) amine-containing silicones, and

(iii) at least one oxidizing agent.

32. A composition according to claim 31, wherein said at least one oxidizing agent is chosen from hydrogen peroxide, urea peroxide, alkali metal bromates, alkali metal ferricyanides, persalts, and oxidation-reduction enzymes

33. A composition according to claim 32, wherein said at least one oxidizing agent is chosen from laccases, peroxidases and 2-electron oxidoreductases, where appropriate in the presence of their respective donor or cofactor.

34. A composition according to claim 32, wherein said at least one oxidizing agent is hydrogen peroxide.

35. A composition according to claim 32, wherein said at least one oxidizing agent comprises a solution of hydrogen peroxide with a titre ranging from 1 to 40 in volume.

36. A composition according to claim 1, wherein said composition for oxidation dyeing keratinous fibers has a pH ranging from 3 to 12.

37. A composition according to claim 31, wherein said composition for oxidation dyeing keratinous fibers has a pH ranging from 3 to 12.

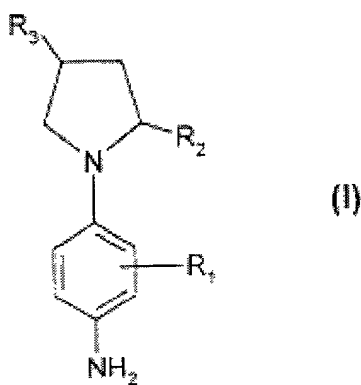
38. A composition according to claim 31 further comprising at least one surfactant chosen from anionic surfactants, cationic surfactants, nonionic surfactants, and

amphoteric surfactants.

39. A composition according to claim 38, wherein said at least one surfactant is present in said composition in an amount ranging from 0.1% to 20% by weight relative to the total weight of said composition.

40. A method for oxidation dyeing keratinous fibers comprising:

- (A) applying to said fibers at least one dyeing composition comprising, in a medium suitable for dyeing:
- (i) at least one oxidation dye precursor chosen from 1-(4-aminophenyl)-pyrrolidines of formula (I) and acid addition salts thereof:



wherein:

- R₁ is chosen from a hydrogen atom, C₁-C₆ alkyl groups, C₁-C₅ monohydroxyalkyl groups, and C₂-C₅ polyhydroxyalkyl groups,
- R₂ is chosen from a hydrogen atom, a -CONH₂ group, C₁-C₅ monohydroxyalkyl

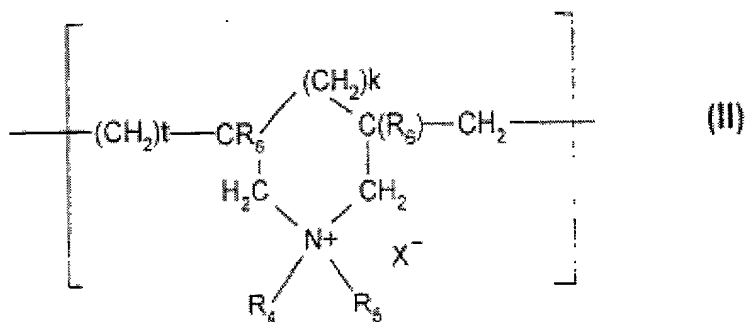
groups, and C₂-C₅ polyhydroxyalkyl groups, and

- R₃ is chosen from a hydrogen atom, and a hydroxyl group,

and optionally comprising:

(ii) at least one cationic polymer chosen from:

(1) homopolymers and copolymers comprising, as a constituent of the chain, at least one unit chosen from units formula (II):



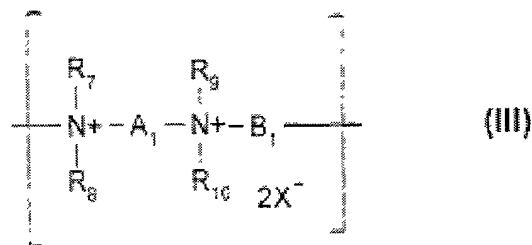
wherein:

- k and t, which are identical or different, are each chosen from 0 and 1, provided that the sum of k + t is equal to 1,
- R₄ and R₅, which are identical or different, are each chosen from (C₁-C₂₂) alkyl groups, (C₁-C₅)-hydroxyalkyl groups, and (C₁-C₄)amidoalkyl groups,
- R₄ and R₅, together with the nitrogen cation to which they are commonly bonded, may optionally form a cationic heterocyclic group chosen from a piperidinyl group and a morpholinyl group,
- R₆, which are identical or different, are each chosen from a hydrogen atom

and a methyl group, and

- X⁻ is an anion;

(2) quaternary diammonium polymers comprising repeating units of formula (III):

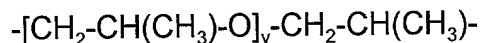


wherein:

- R₇, R₈, R₉, and R₁₀, which are identical or different, are each chosen from C₁-C₂₀ aliphatic groups, C₃-C₂₀ alicyclic groups, C₇-C₂₀ arylaliphatic groups, and lower hydroxyalkyl groups,
- at least two of said R₇, said R₈, said R₉, and said R₁₀, together with the nitrogen cations to which they are attached, optionally form at least one cationic heterocyclic ring optionally comprising an additional heteroatom other than nitrogen,
- R₇, R₈, R₉, and R₁₀, which are identical or different, optionally are each chosen from linear and branched C₁-C₆ alkyl groups substituted with at least one group chosen from nitrile groups, ester groups, acyl groups, amide groups, -CO-O-R₁₁-D groups, and -CO-NH-R₁₁-D groups, wherein R₁₁ is chosen from alkylene groups and D is chosen from

quaternary ammonium groups,

- A₁ and B₁, which are identical or different, are each chosen from linear and branched, saturated and unsaturated, C₂-C₂₀ polymethylene groups, optionally comprising at least one entity chosen from aromatic rings, an oxygen atom, a sulfur atom, a sulfoxide group, a sulfone group, a disulfide group, an amino group, alkylamino groups, a hydroxyl group, quaternary ammonium groups, a ureido group, an amide group, and ester groups, wherein said at least one entity is linked to or intercalated in the main chain,
- X⁻ is an anion,
- said A₁, said R₇, and said R₉ optionally form a piperazine ring, together with the two nitrogen cations to which they are attached, and
- provided that if A₁ is chosen from linear and branched, saturated and unsaturated, C₂-C₂₀ polymethylene groups and linear and branched, saturated and unsaturated, hydroxy(C₂-C₂₀)polymethylene groups, B₁ is additionally chosen from
 - (CH₂)_n-CO-D-OC-(CH₂)_n- groups, wherein:
 - n is an integer ranging from 1 to 100, and
 - D is chosen from:
 - a) glycol residues of formula: -O-Z-O-, wherein Z is chosen from linear and branched hydrocarbon groups and groups chosen from groups of formulae:
 - (CH₂-CH₂-O)_x-CH₂-CH₂- and



wherein x and y, which are identical or different, are each chosen from integers ranging from 1 to 4 (in which case x and y represent a defined and unique degree of polymerization) and any number ranging from 1 to 4 (in which case x and y represent an average degree of polymerization),

b) bis-secondary diamine residues,

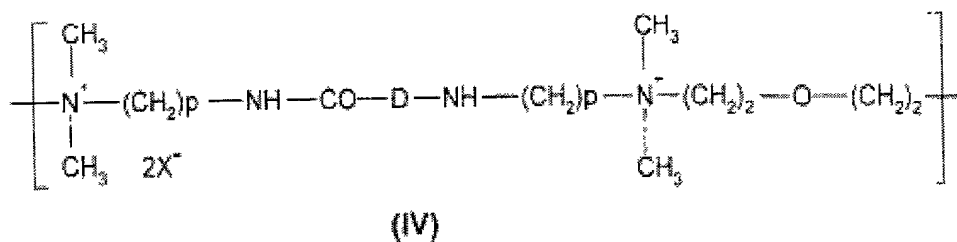
c) bis-primary diamine residues chosen from residues of formula:

-NH-Y-NH-, wherein Y is chosen from linear and branched hydrocarbon groups and residues of formula



d) a ureylene group of formula: -NH-CO-NH-;

(3) quaternary diammonium polymers comprising repeating units of formula (IV):



wherein:

- p is an integer ranging from 1 to 6,

- D is chosen from a direct bond and $-(\text{CH}_2)_r-\text{CO}-$ groups, wherein r is a number equal to 4 or 7, and

- X^- is an anion;

(4) amine-containing silicones, and

(B) developing a color by applying to said fibers at least one oxidizing composition comprising:

- at least one oxidizing agent and
- optionally comprising said at least one cationic polymer as defined above,
- wherein said at least one oxidizing composition is
 - applied to said fibers after combining, at the time of use, said at least one oxidizing composition with said at least one dyeing composition, or
 - applied to said fibers either simultaneously with or immediately after said at least one dyeing composition, without intermediate rinsing, and

(C) provided that said at least one cationic polymer is present in at least one of said at least one dyeing composition or said at least one oxidizing composition.

41. A method according to claim 40, wherein said keratinous fibers are human keratinous fibers.

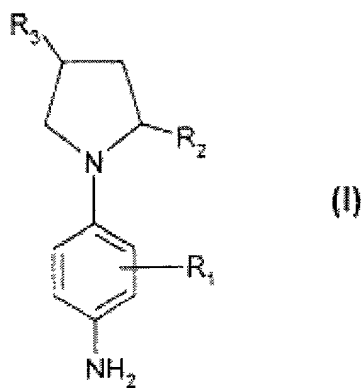
42. A method according to claim 41, wherein said human keratinous fibers are human hair.

43. A method for oxidation dyeing keratinous fibers comprising:

(A) preparing at least one dyeing composition comprising, in a medium suitable for dyeing:

(i) at least one oxidation dye precursor chosen from 1-(4-aminophenyl)-pyrrolidines

of formula (I) and acid addition salts thereof:

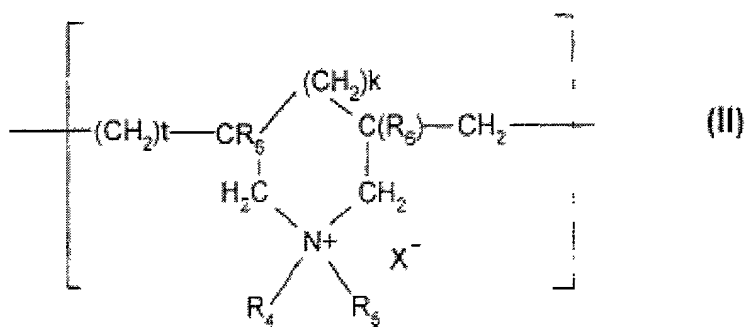


wherein:

- R_1 is chosen from a hydrogen atom, C_1 - C_6 alkyl groups, C_1 - C_5 monohydroxyalkyl groups, and C_2 - C_5 polyhydroxyalkyl groups,
- R_2 is chosen from a hydrogen atom, a $-CONH_2$ group, C_1 - C_5 monohydroxyalkyl groups, and C_2 - C_5 polyhydroxyalkyl groups, and
- R_3 is chosen from a hydrogen atom, and a hydroxyl group,

(ii) at least one cationic polymer chosen from:

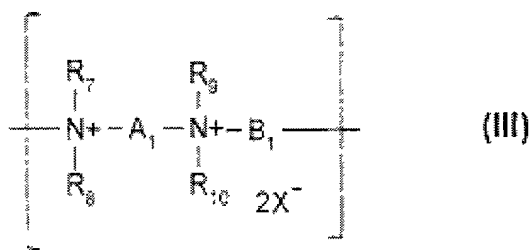
- (1) homopolymers and copolymers comprising, as a constituent of the chain, at least one unit chosen from units formula (II):



wherein:

- k and t, which are identical or different, are each chosen from 0 and 1, provided that the sum of k + t is equal to 1,
- R₄ and R₅, which are identical or different, are each chosen from (C₁-C₂₂) alkyl groups, (C₁-C₅)-hydroxyalkyl groups, and (C₁-C₄)amidoalkyl groups,
- R₄ and R₅, together with the nitrogen cation to which they are commonly bonded, may optionally form a cationic heterocyclic group chosen from a piperidinyl group and a morpholinyl group,
- R₆, which are identical or different, are each chosen from a hydrogen atom and a methyl group, and
- X⁻ is an anion;

(2) quaternary diammonium polymers comprising repeating units of formula (III):



wherein:

- R_7 , R_8 , R_9 , and R_{10} , which are identical or different, are each chosen from C_1 - C_{20} aliphatic groups, C_3 - C_{20} alicyclic groups, C_7 - C_{20} arylaliphatic groups, and lower hydroxyalkyl groups,
- at least two of said R_7 , said R_8 , said R_9 , and said R_{10} , together with the nitrogen cations to which they are attached, optionally form at least one cationic heterocyclic ring optionally comprising an additional heteroatom other than nitrogen,
- R_7 , R_8 , R_9 , and R_{10} , which are identical or different, optionally are each chosen from linear and branched C_1 - C_6 alkyl groups substituted with at least one group chosen from nitrile groups, ester groups, acyl groups, amide groups, $-\text{CO}-\text{O}-R_{11}-\text{D}$ groups, and $-\text{CO}-\text{NH}-R_{11}-\text{D}$ groups, wherein R_{11} is chosen from alkylene groups and D is chosen from quaternary ammonium groups,
- A_1 and B_1 , which are identical or different, are each chosen from linear and branched, saturated and unsaturated, C_2 - C_{20} polymethylene groups, optionally comprising at least one entity chosen from aromatic rings,

an oxygen atom, a sulfur atom, a sulfoxide group, a sulfone group, a disulfide group, an amino group, alkylamino groups, a hydroxyl group, quaternary ammonium groups, a ureido group, an amide group, and ester groups, wherein said at least one entity is linked to or intercalated in the main chain.

- X^- is an anion,
 - said A_1 , said R_7 , and said R_9 optionally form a piperazine ring, together with the two nitrogen cations to which they are attached, and
 - provided that if A_1 is chosen from linear and branched, saturated and unsaturated, C_2 - C_{20} polymethylene groups and linear and branched, saturated and unsaturated, hydroxy(C_2 - C_{20})polymethylene groups, B_1 is additionally chosen from
 - (CH_2) $_n$ -CO-D-OC-(CH_2) $_n$ - groups, wherein:
 - n is an integer ranging from 1 to 100, and
 - D is chosen from:
 - a) glycol residues of formula: -O-Z-O-, wherein Z is chosen from linear and branched hydrocarbon groups and groups chosen from groups of formulae:
 - (CH_2 - CH_2 -O) $_x$ - CH_2 - CH_2 - and
 - [CH_2 -CH(CH_3)-O] $_y$ - CH_2 -CH(CH_3)-
- wherein x and y , which are identical or different, are each chosen from integers ranging from 1 to 4 (in which case x and y represent a defined and unique degree of polymerization) and

any number ranging from 1 to 4 (in which case x and y represent an average degree of polymerization),

b) bis-secondary diamine residues,

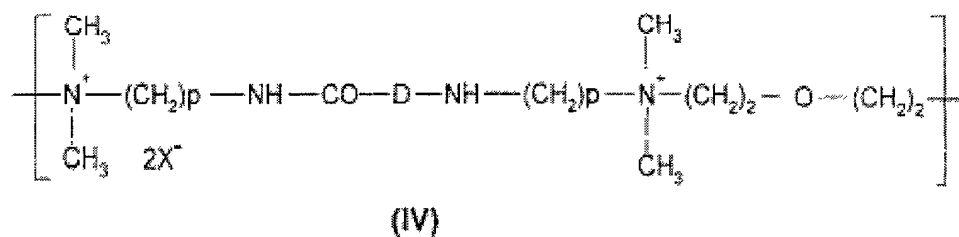
c) bis-primary diamine residues chosen from residues of formula:

-NH-Y-NH-, wherein Y is chosen from linear and branched hydrocarbon groups and residues of formula

-CH₂-CH₂-S-S-CH₂-CH₂-, and

d) a ureylene group of formula: -NH-CO-NH-;

(3) quaternary diammonium polymers comprising repeating units of formula (IV):



wherein:

- p is an integer ranging from 1 to 6,

- D is chosen from a direct bond and -(CH₂)_r-CO- groups, wherein r is a number equal to 4 or 7, and

- X⁻ is an anion;

(4) amine-containing silicones, and

(iii) at least one oxidizing agent,

- wherein said at least one dyeing composition is prepared, at the time of use, by combining (i), (ii), and (iii) above,

- (B) developing a color by applying said at least one dyeing composition prepared in (A) above to said fibers,
- (C) leaving said at least one dyeing composition prepared in (A) above on said fibers for a time ranging from 1 to 60 minutes,
- (D) rinsing said fibers, optionally shampooing said fibers, and optionally further rinsing said fibers, and
- (E) drying said fibers.

44. A method according to claim 43, wherein said keratinous fibers are human keratinous fibers.

45. A method according to claim 44, wherein said human keratinous fibers are human hair.

46. A method according to claim 43, wherein said leaving time is a time ranging from 10 to 45 minutes.

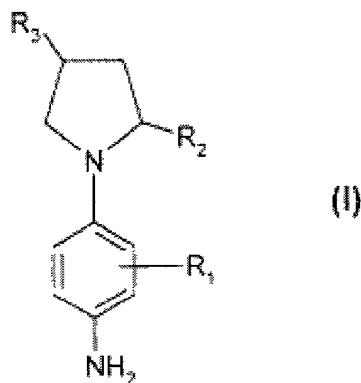
47. A method according to claim 45, wherein said human hair is chosen from wet human hair and dry human hair.

48. A kit for oxidation dyeing keratinous fibers comprising at least two compartments, wherein:

- (A) a first compartment comprises at least one dyeing composition comprising, in a medium suitable for dyeing:

- (i) at least one oxidation dye precursor chosen from 1-(4-aminophenyl)-pyrrolidines

of formula (I) and acid addition salts thereof:



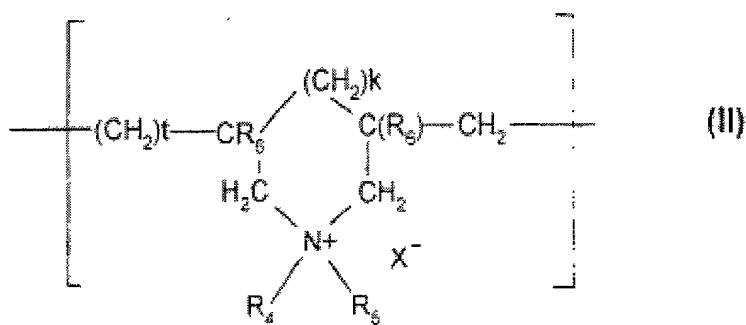
wherein:

- R₁ is chosen from a hydrogen atom, C₁-C₆ alkyl groups, C₁-C₅ monohydroxyalkyl groups, and C₂-C₅ polyhydroxyalkyl groups,
- R₂ is chosen from a hydrogen atom, a -CONH₂ group, C₁-C₅ monohydroxyalkyl groups, and C₂-C₅ polyhydroxyalkyl groups, and
- R₃ is chosen from a hydrogen atom, and a hydroxyl group,

and optionally comprising:

(ii) at least one cationic polymer chosen from:

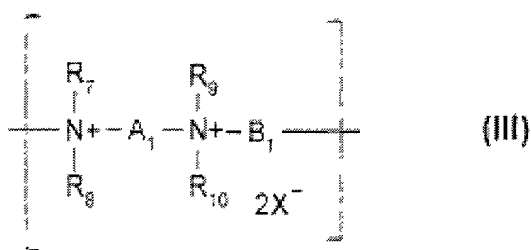
- (1) homopolymers and copolymers comprising, as a constituent of the chain, at least one unit chosen from units formula (II):



wherein:

- k and t, which are identical or different, are each chosen from 0 and 1,
provided that the sum of k + t is equal to 1,
- R₄ and R₅, which are identical or different, are each chosen from
(C₁-C₂₂) alkyl groups, (C₁-C₅)-hydroxyalkyl groups, and
(C₁-C₄)amidoalkyl groups,
- R₄ and R₅, together with the nitrogen cation to which they are commonly
bonded, may optionally form a cationic heterocyclic group chosen from
a piperidinyl group and a morpholinyl group,
- R₆, which are identical or different, are each chosen from a hydrogen atom
and a methyl group, and
- X⁻ is an anion;

(2) quaternary diammonium polymers comprising repeating units of formula (III):



wherein:

- R_7 , R_8 , R_9 , and R_{10} , which are identical or different, are each chosen from C_1 - C_{20} aliphatic groups, C_3 - C_{20} alicyclic groups, C_7 - C_{20} arylaliphatic groups, and lower hydroxyalkyl groups,
- at least two of said R_7 , said R_8 , said R_9 , and said R_{10} , together with the nitrogen cations to which they are attached, optionally form at least one cationic heterocyclic ring optionally comprising an additional heteroatom other than nitrogen,
- R_7 , R_8 , R_9 , and R_{10} , which are identical or different, optionally are each chosen from linear and branched C_1 - C_6 alkyl groups substituted with at least one group chosen from nitrile groups, ester groups, acyl groups, amide groups, $-\text{CO}-\text{O}-\text{R}_{11}-\text{D}$ groups, and $-\text{CO}-\text{NH}-\text{R}_{11}-\text{D}$ groups, wherein R_{11} is chosen from alkylene groups and D is chosen from quaternary ammonium groups,
- A_1 and B_1 , which are identical or different, are each chosen from linear and branched, saturated and unsaturated, C_2 - C_{20} polymethylene groups, optionally comprising at least one entity chosen from aromatic rings,

an oxygen atom, a sulfur atom, a sulfoxide group, a sulfone group, a disulfide group, an amino group, alkylamino groups, a hydroxyl group, quaternary ammonium groups, a ureido group, an amide group, and ester groups, wherein said at least one entity is linked to or intercalated in the main chain,

- X^- is an anion,
 - said A_1 , said R_7 , and said R_9 optionally form a piperazine ring, together with the two nitrogen cations to which they are attached, and
 - provided that if A_1 is chosen from linear and branched, saturated and unsaturated, C_2 - C_{20} polymethylene groups and linear and branched, saturated and unsaturated, hydroxy(C_2 - C_{20})polymethylene groups, B_1 is additionally chosen from
 - (CH_2) $_n$ -CO-D-OC-(CH_2) $_n$ - groups, wherein:
 - n is an integer ranging from 1 to 100, and
 - D is chosen from:
 - a) glycol residues of formula: -O-Z-O-, wherein Z is chosen from linear and branched hydrocarbon groups and groups chosen from groups of formulae:
 - (CH_2 - CH_2 -O) $_x$ - CH_2 - CH_2 - and
 - [CH_2 -CH(CH_3)-O] $_y$ - CH_2 -CH(CH_3)-
- wherein x and y, which are identical or different, are each chosen from integers ranging from 1 to 4 (in which case x and y represent a defined and unique degree of polymerization) and

any number ranging from 1 to 4 (in which case x and y represent an average degree of polymerization),

b) bis-secondary diamine residues,

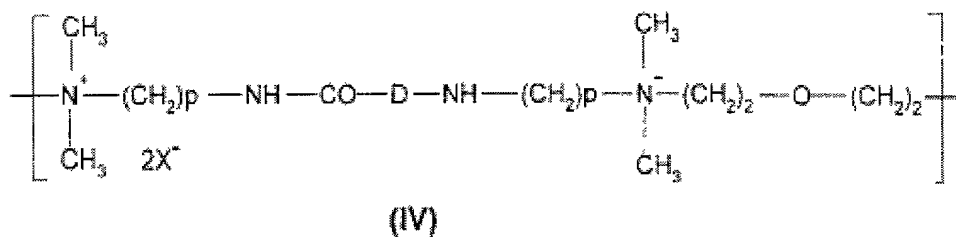
c) bis-primary diamine residues chosen from residues of formula:

-NH-Y-NH-, wherein Y is chosen from linear and branched hydrocarbon groups and residues of formula

-CH₂-CH₂-S-S-CH₂-CH₂-, and

d) a ureylene group of formula: -NH-CO-NH-;

(3) quaternary diammonium polymers comprising repeating units of formula (IV):



wherein:

- p is an integer ranging from 1 to 6,

- D is chosen from a direct bond and -(CH₂)_r-CO- groups, wherein r is a number equal to 4 or 7, and

- X⁻ is an anion; and

(4) amine-containing silicones, and

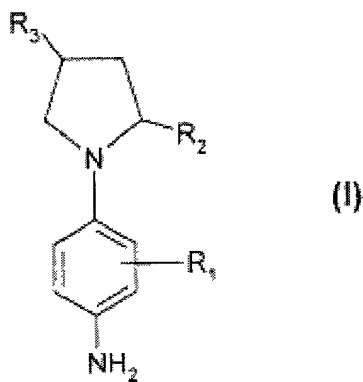
- (B) a second compartment comprises at least one oxidizing agent and optionally comprises said at least one cationic polymer as defined above, and
- (C) provided that said at least one cationic polymer is present in at least one of said first compartment or said second compartment.

49. A kit according to claim 48, wherein said keratinous fibers are human keratinous fibers.

50. A kit according to claim 49, wherein said human keratinous fibers are human hair.

51. A kit for oxidation dyeing keratinous fibers comprising at least three compartments, wherein:

- (A) a first compartment comprises at least one dyeing composition comprising, in a medium suitable for dyeing, at least one oxidation dye precursor chosen from 1-(4-aminophenyl)-pyrrolidines of formula (I) and acid addition salts thereof:

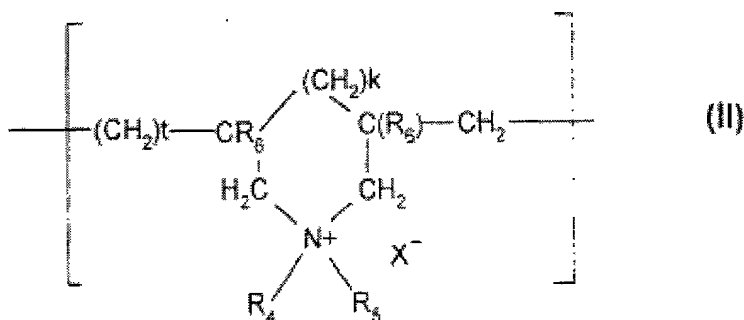


wherein:

- R_1 is chosen from a hydrogen atom, C_1 - C_6 alkyl groups, C_1 - C_5 monohydroxyalkyl groups, and C_2 - C_5 polyhydroxyalkyl groups,
- R_2 is chosen from a hydrogen atom, a $-\text{CONH}_2$ group, C_1 - C_5 monohydroxyalkyl groups, and C_2 - C_5 polyhydroxyalkyl groups, and
- R_3 is chosen from a hydrogen atom, and a hydroxyl group,

(B) a second compartment comprises at least one cationic polymer chosen from:

- (1) homopolymers and copolymers comprising, as a constituent of the chain, at least one unit chosen from units formula (II):

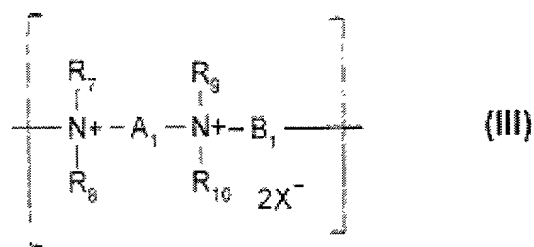


wherein:

- k and t , which are identical or different, are each chosen from 0 and 1, with the proviso that the sum of $k + t$ is equal to 1,
- R_4 and R_5 , which are identical or different, are each chosen from $(C_1$ - $C_{22})$ alkyl groups, $(C_1$ - $C_5)$ -hydroxyalkyl groups, and $(C_1$ - $C_4)$ amidoalkyl groups,

- R_4 and R_5 , together with the nitrogen cation to which they are commonly bonded, may optionally form a cationic heterocyclic group chosen from a piperidiny1 group and a morpholinyl group,
- R_6 , which are identical or different, are each chosen from a hydrogen atom and a methyl group, and
- X^- is an anion;

(2) quaternary diammonium polymers comprising repeating units of formula (III):



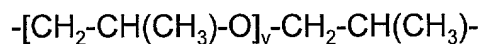
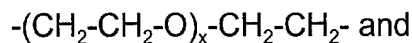
wherein:

- R_7 , R_8 , R_9 , and R_{10} , which are identical or different, are each chosen from C_1 - C_{20} aliphatic groups, C_3 - C_{20} alicyclic groups, C_7 - C_{20} arylaliphatic groups, and lower hydroxyalkyl groups,
- at least two of said R_7 , said R_8 , said R_9 , and said R_{10} , together with the nitrogen cations to which they are attached, optionally form at least one cationic heterocyclic ring optionally comprising an additional heteroatom other than nitrogen,
- R_7 , R_8 , R_9 , and R_{10} , which are identical or different, optionally are each

chosen from linear and branched C_1 - C_6 alkyl groups substituted with at least one group chosen from nitrile groups, ester groups, acyl groups, amide groups, $-CO-O-R_{11}-D$ groups, and $-CO-NH-R_{11}-D$ groups, wherein R_{11} is chosen from alkylene groups and D is chosen from quaternary ammonium groups,

- A_1 and B_1 , which are identical or different, are each chosen from linear and branched, saturated and unsaturated, C_2 - C_{20} polymethylene groups, optionally comprising at least one entity chosen from aromatic rings, an oxygen atom, a sulfur atom, a sulfoxide group, a sulfone group, a disulfide group, an amino group, alkylamino groups, a hydroxyl group, quaternary ammonium groups, a ureido group, an amide group, and ester groups, wherein said at least one entity is linked to or intercalated in the main chain,
- X^- is an anion,
- said A_1 , said R_7 , and said R_9 optionally form a piperazine ring, together with the two nitrogen cations to which they are attached, and
- provided that if A_1 is chosen from linear and branched, saturated and unsaturated, C_2 - C_{20} polymethylene groups and linear and branched, saturated and unsaturated, hydroxy(C_2 - C_{20})polymethylene groups, B_1 is additionally chosen from
 - $-(CH_2)_n-CO-D-OC-(CH_2)_n-$ groups, wherein:
 - n is an integer ranging from 1 to 100, and
 - D is chosen from:

a) glycol residues of formula: $-O-Z-O-$, wherein Z is chosen from linear and branched hydrocarbon groups and groups chosen from groups of formulae:

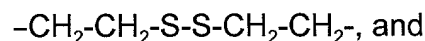


wherein x and y, which are identical or different, are each chosen from integers ranging from 1 to 4 (in which case x and y represent a defined and unique degree of polymerization) and any number ranging from 1 to 4 (in which case x and y represent an average degree of polymerization),

b) bis-secondary diamine residues,

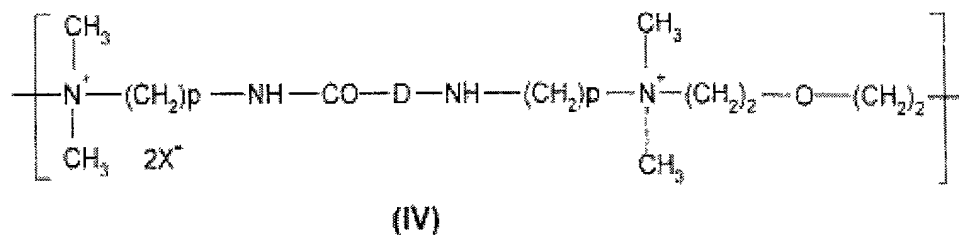
c) bis-primary diamine residues chosen from residues of formula:

$-NH-Y-NH-$, wherein Y is chosen from linear and branched hydrocarbon groups and residues of formula



d) a ureylene group of formula: $-NH-CO-NH-$;

(3) quaternary diammonium polymers comprising repeating units of formula (IV):



wherein:

- p is an integer ranging from 1 to 6,
- D is chosen from a direct bond and $-(\text{CH}_2)_r\text{-CO-}$ groups, wherein r is a number equal to 4 or 7, and
- X^- is an anion; and

(4) amine-containing silicones, and

(C) a third compartment comprises at least one oxidizing agent.

52. A kit according to claim 51, wherein said keratinous fibers are human keratinous fibers.

53. A kit according to claim 52, wherein said human keratinous fibers are human hair.